CLAIMS

It is claimed:

1. An apparatus for detecting hydrogenous materials, comprising:

a. a time-tagged neutron source that provides a stream of fast neutrons directed toward a target;

b. at least one sensing head comprising a neutron sensor and a neutron shield, wherein a portion of said stream of fast neutrons is backscattered from said target to said neutron sensor that produces a neutron count signal dependent on the amount of hydrogenous material present in said target; and

c. a control system comprising a timing circuit, wherein said timing circuit disables said neutron sensor during a time delay beginning at the time said stream of fast neutrons is emitted from said neutron source and enables said neutron sensor after said time delay.

2. The apparatus as recited in claim 1, wherein said timing circuit enables said neutron sensor after said time delay during a window and disables said neutron sensor after said window.

3. The apparatus as recited in claim 1, wherein said control system further comprises a pulse-height analyzer with at least one pulse-height discriminator setting.

4. The apparatus as recited in claim 3, wherein said at least one pulse-height discriminator setting is an upper level discriminator setting.

5. The apparatus as recited in claim 1, wherein said neutron sensor is

capable of spatially resolving said neutron count signal so that the location of said target can be determined.

6. The apparatus as recited in claim 5, wherein said neutron sensor comprises a collimating material.

7. The apparatus as recited in claim 5, wherein said neutron sensor comprises a coded-array aperture.

8. The apparatus as recited in claim 1, wherein said neutron source is selected from the group consisting of a fission source, an (alpha, n) source, a (gamma, n) source, and combinations thereof.

9. The apparatus as recited in claim 8, wherein said fission source comprises ^{252}Cf.

10. The apparatus as recited in claim 1, wherein said neutron source is a neutron generator that is capable of being operated in pulse mode.

11. The apparatus as recited in claim 1, wherein said neutron sensor comprises a material selected from the group consisting of ^{3}He, ^{10}B, ^{6}Li, and combinations thereof.

12. The apparatus as recited in claim 1, wherein said neutron sensor is selected from the group consisting of a ^{3}He gas-proportional counter, a $^{10}BF_3$ gas-proportional counter, a scintillating glass containing ^{6}Li, a scintillating glass containing ^{10}B, a scintillating plastic containing ^{6}Li, a scintillating plastic containing ^{10}B, a scintillating crystal containing ^{6}Li, a scintillating crystal containing ^{10}B, and combinations thereof.

13. The apparatus as recited in claim 1, wherein said neutron shield comprises a material selected from the group consisting of ^{10}B, ^{6}Li, and combinations thereof.

14. The apparatus as recited in claim 1, further comprising an extension arm, one end of said extension arm connected to said sensing head and the other end of said extension arm connected to said control system.

15. The apparatus as recited in claim 1, further comprising a user interface wherein said user interface comprises a means for communicating said neutron count signal to a user.

16. A method for detecting hydrogenous materials comprising the steps of:

a. directing a stream of fast neutrons from a neutron source toward a target;

b. detecting the time when said stream of fast neutrons is emitted from said neutron source;

c. measuring a portion of said stream of fast neutrons that is backscattered from said target after a time delay beginning when said stream of fast neutrons is emitted from said source; and

d. communicating said measurement to a user.

17. The method as recited in claim 16, wherein said measuring occurs after said time delay and only during a window.

18. The method as recited in claim 16, further comprising the step of pulse-height discriminating said measurement.

19. The method as recited in claim 18, wherein said discriminating is performed using an upper level discriminator setting.

20. The method as recited in claim 16, wherein said target comprises an explosive.

21. The method as recited in claim 16, wherein said explosive is a land mine.

22. The method as recited in claim 16, wherein said explosive is unexploded ordinance.

23. The method as recited in claim 16, wherein said target is contraband narcotics.

24. The method as recited in claim 16, wherein said target is biological tissue.